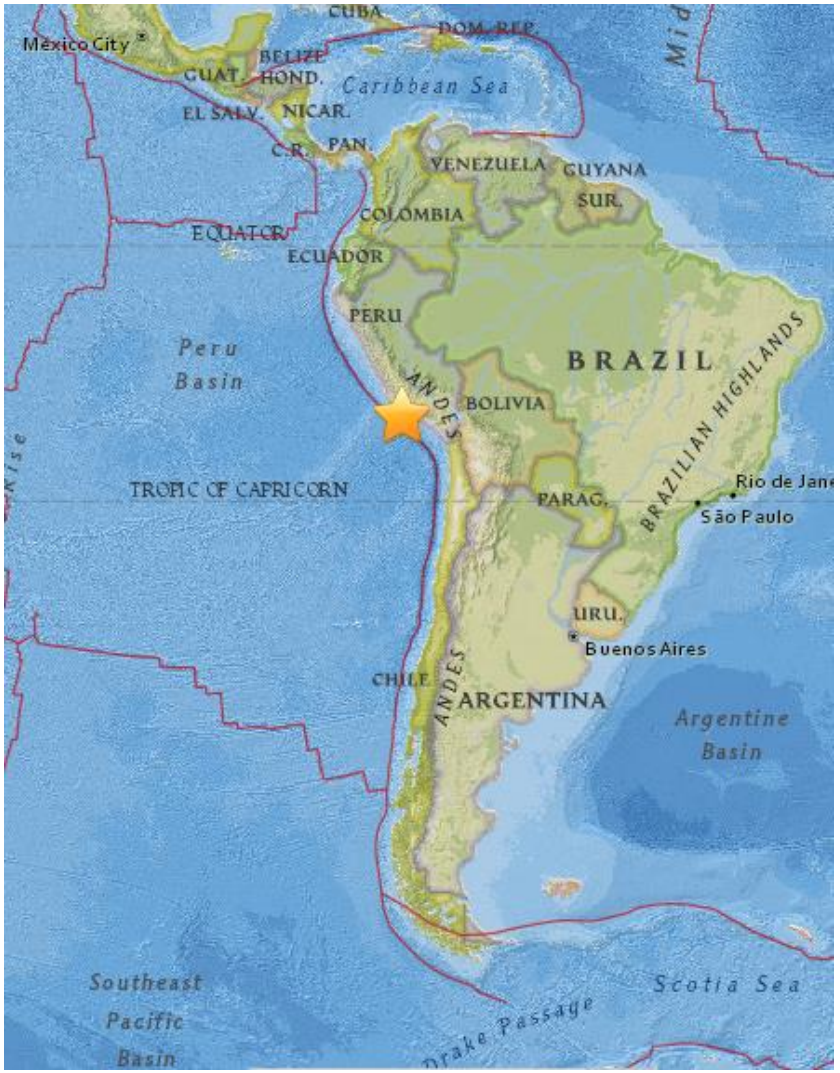
Magnitude 7.1 PERU

Sunday, January 14, 2018 at 09:18:45 UTC

A magnitude 7.1 earthquake has occurred offshore Peru. The earthquake struck just after 4 a.m. local time and was centered near the coast of Peru, 40 km (25 miles) south-southwest of Acari, Peru at a depth of 36.3 km (22.5 miles).

There are early reports of homes and roads collapsed leaving one dead and several dozen injured.

The U.S Pacific Tsunami Warning Center initially warned of possible tsunami waves for areas of Peru's southern coast. The center later issued a bulletin saying no such waves were detected and the threat had passed.



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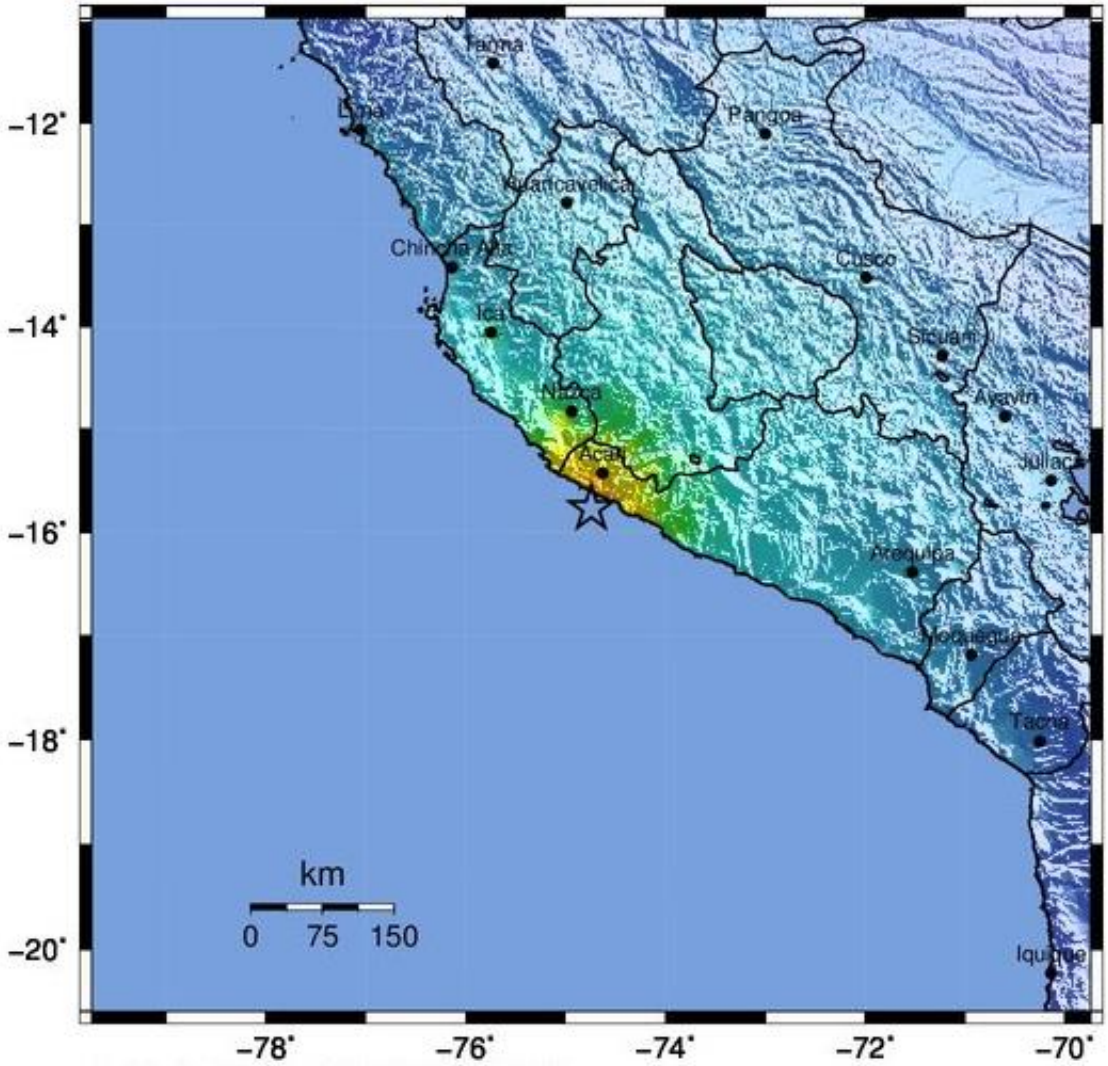
The Modified-Mercalli Intensity scale is a twelve-stage scale, from I to XII, that indicates the severity of ground shaking.

The area nearest the earthquake experienced very strong shaking.

Modified Mercalli Intensity	Perceived Shaking
X	Extreme
IX	Violent
VIII	Severe
VII	Very Strong
VI	Strong
V	Moderate
IV	Light
II-III	Weak
I	Not Felt

Image courtesy of the US Geological Survey



USGS Estimated shaking intensity from M 7.1 Earthquake

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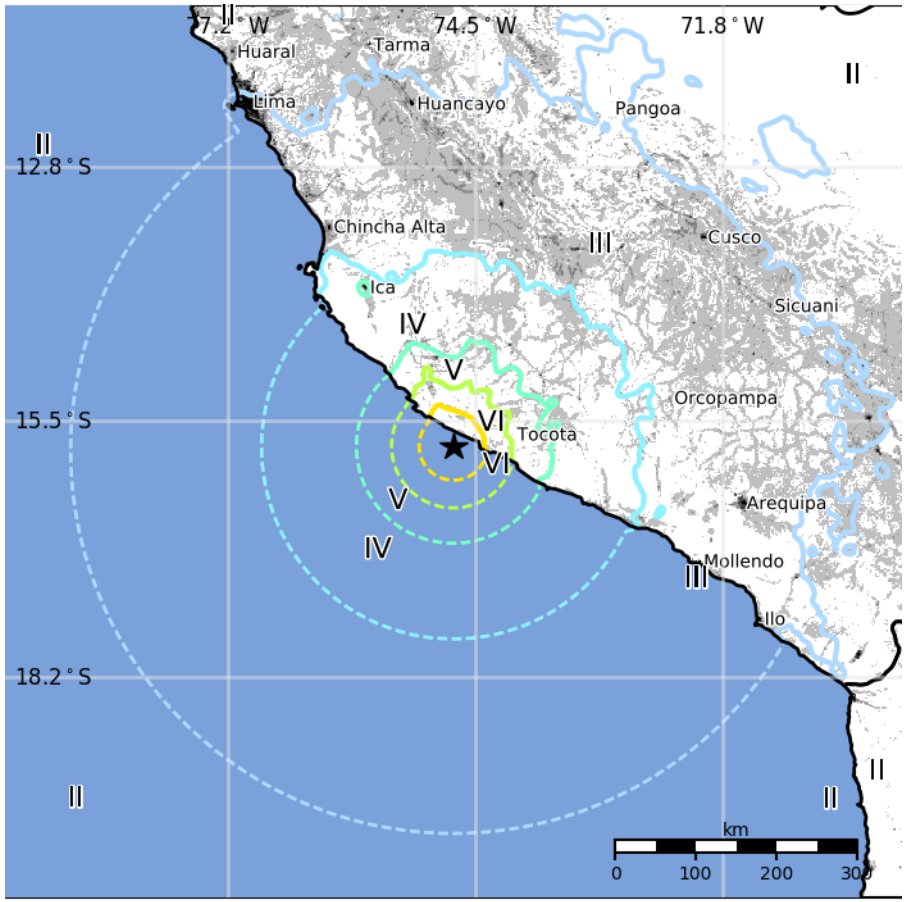
IRIS Teachable Moments

USGS PAGER
Population Exposed to Earthquake Shaking

The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels.

The USGS estimates that over six thousand people felt very strong shaking from this earthquake.



MMI	Shaking	Pop.
I	Not Felt	--*
II-III	Weak	18,255 k*
IV	Light	430 k
V	Moderate	438 k
VI	Strong	21 k
VII	Very Strong	6 k
VIII	Severe	0 k

The color coded contour lines outline regions of MMI intensity. The total population exposure to a given MMI value is obtained by summing the population between the contour lines. The estimated population exposure to each MMI Intensity is shown in the table.

Image courtesy of the US Geological Survey

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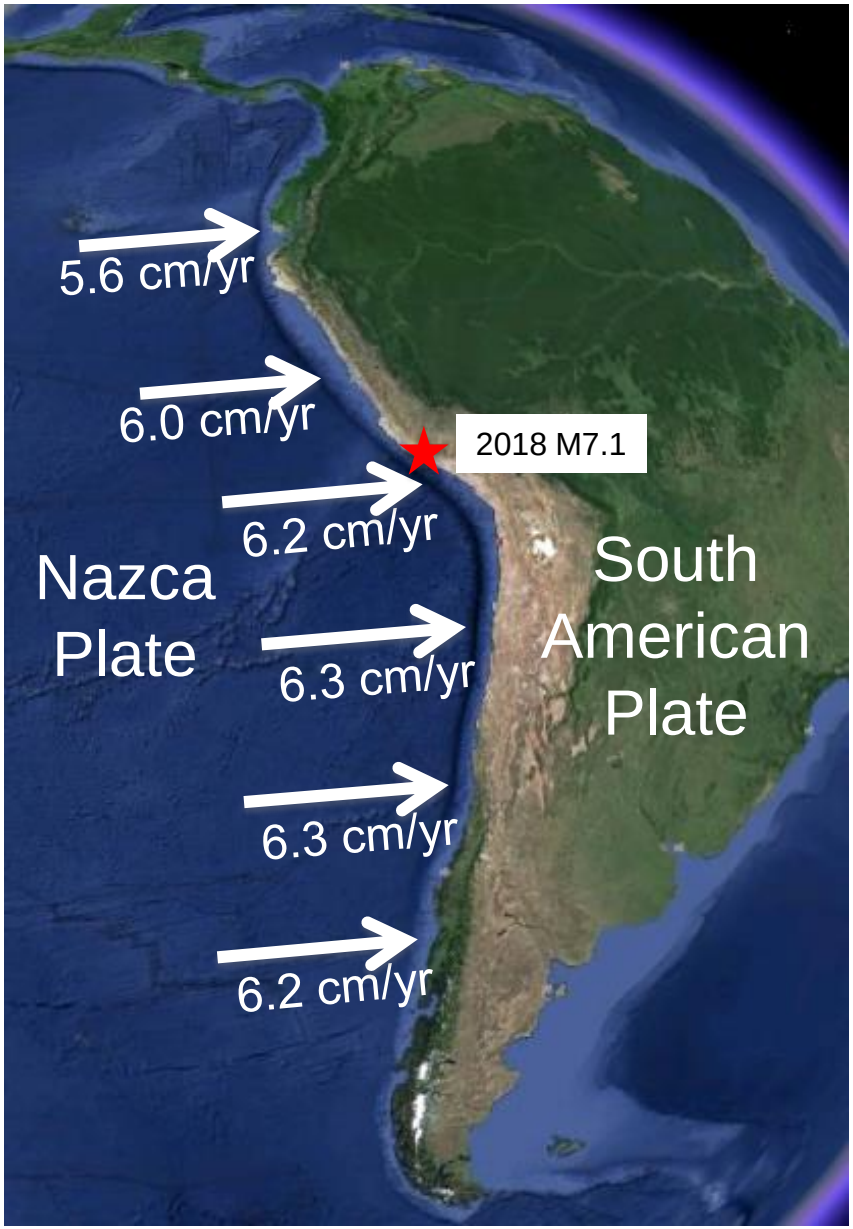
Lithospheric plates are actually spherical shells on Earth's surface so relative plate motions are best described as relative plate rotations. This means that rates of relative plate motion change with location on a long plate boundary such as the Nazca – South America Plate boundary. The map on the right illustrates how the convergence rate of the Nazca Plate toward the South American Plate ranges from 5.6 cm/yr to 6.3 cm/yr.

These rates have recently been updated using Global Positioning System (GPS) observations from islands on the Nazca Plate and numerous GPS stations in South America. At the location of this earthquake, the rate of convergence is about 6.2 cm/yr.



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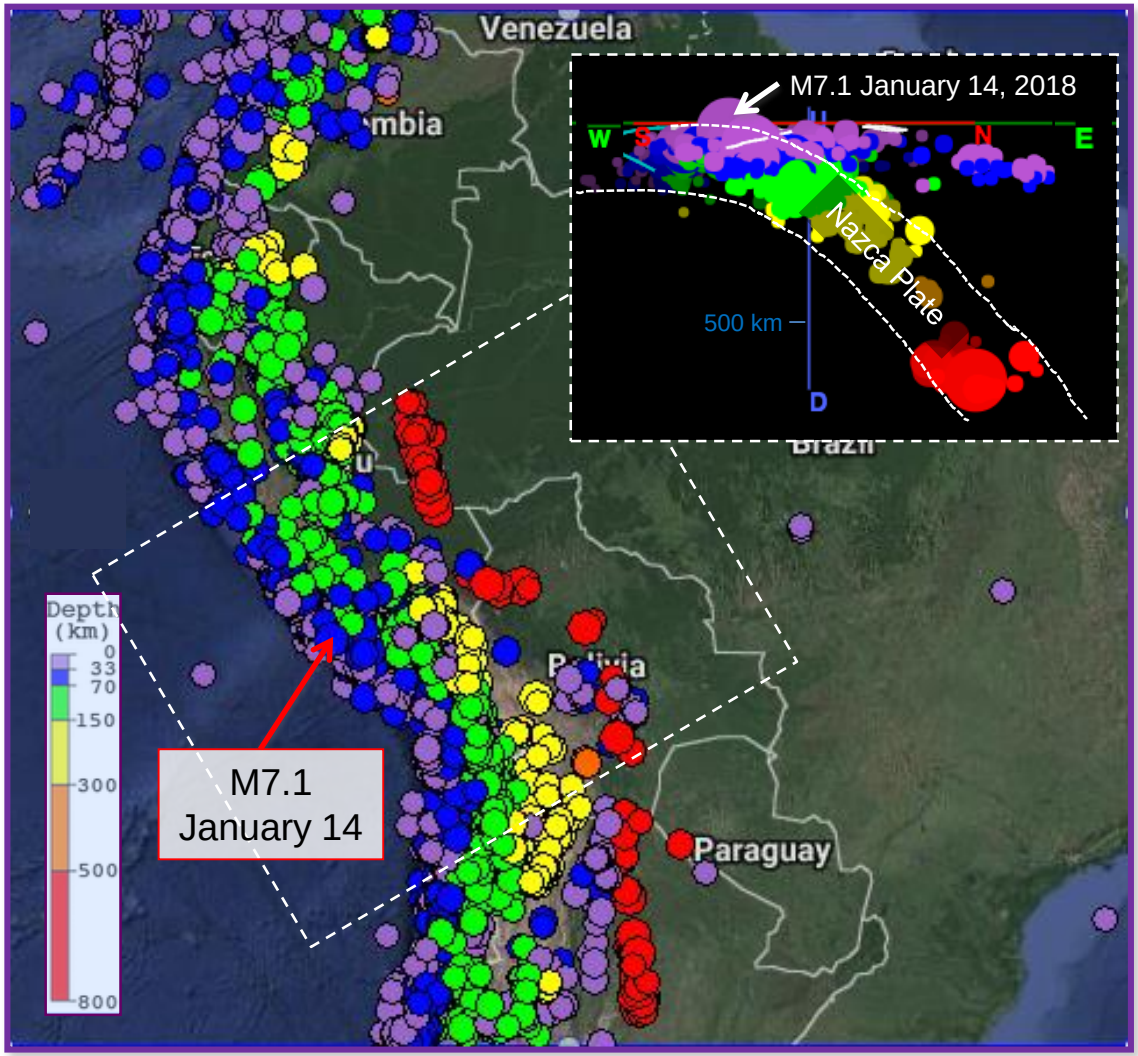
This map shows the 3000 most recent earthquakes of magnitude 5 or larger along the west coast of northern South America. The epicenter of this earthquake is labeled. Earthquakes are color-coded by depth as shown by the legend in the lower left corner.

A cross section of earthquakes within the dashed rectangle on the map is shown in the upper right corner. The outline of the Nazca Plate is shown in light dashed lines on the cross section. Depths of earthquakes increase from west to east across the Nazca – South America subduction zone. Earthquakes deeper than 100 km occur within the subducting Nazca Plate.



Map created using the IRIS Earthquake Browser (IEB).

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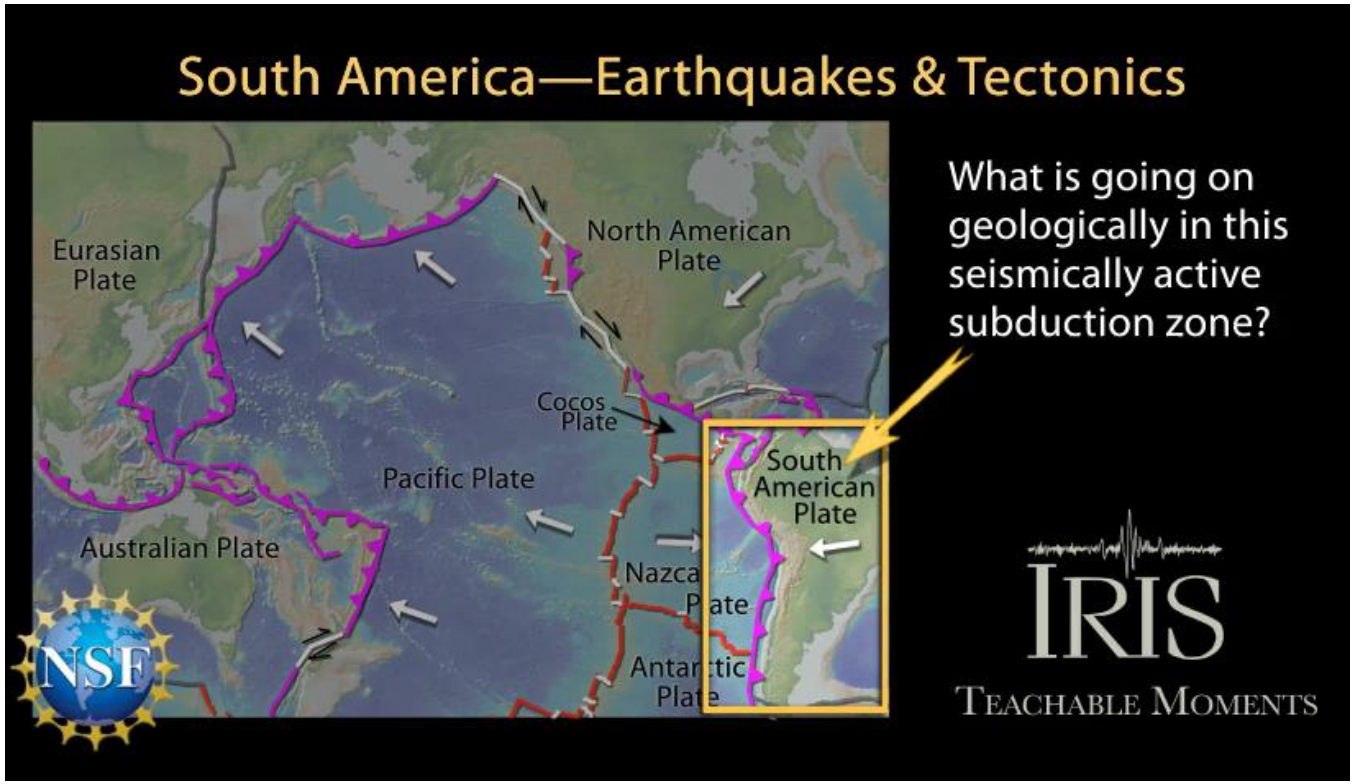
This magnitude 7.1 earthquake is typical of subduction zone earthquakes on the shallow portion of the Nazca – South America Plate boundary. Earthquakes also occur within the shallow portions of both plates near the boundary. Normal-faulting earthquakes often occur within the top portion of the Nazca Plate as it bends to descend beneath South America. Earthquakes at depths greater than 100 km are within the subducting Nazca Plate.



Animation exploring plate tectonics and earthquakes of the Nazca – South America plate boundary region.

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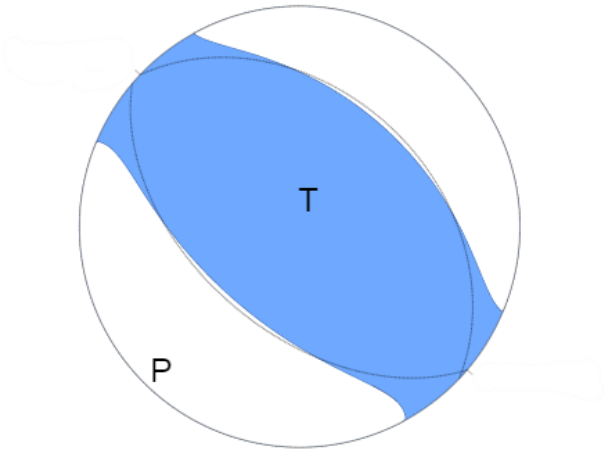
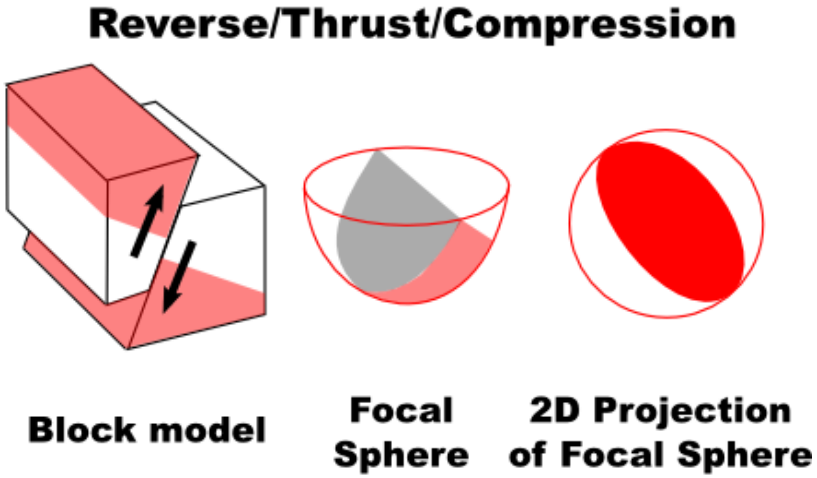
The focal mechanism is how seismologists plot the 3-D stress orientations of an earthquake. Because an earthquake occurs as slip on a fault, it generates primary (P) waves in quadrants where the first pulse is compressional (shaded) and quadrants where the first pulse is extensional (white). The orientation of these quadrants determined from recorded seismic waves determines the type of fault that produced the earthquake.



USGS W-phase Moment Tensor Solution

The tension axis (T) reflects the minimum compressive stress direction. The pressure axis (P) reflects the maximum compressive stress direction.



In this case, the focal mechanism indicates this earthquake occurred as the result of thrust faulting.

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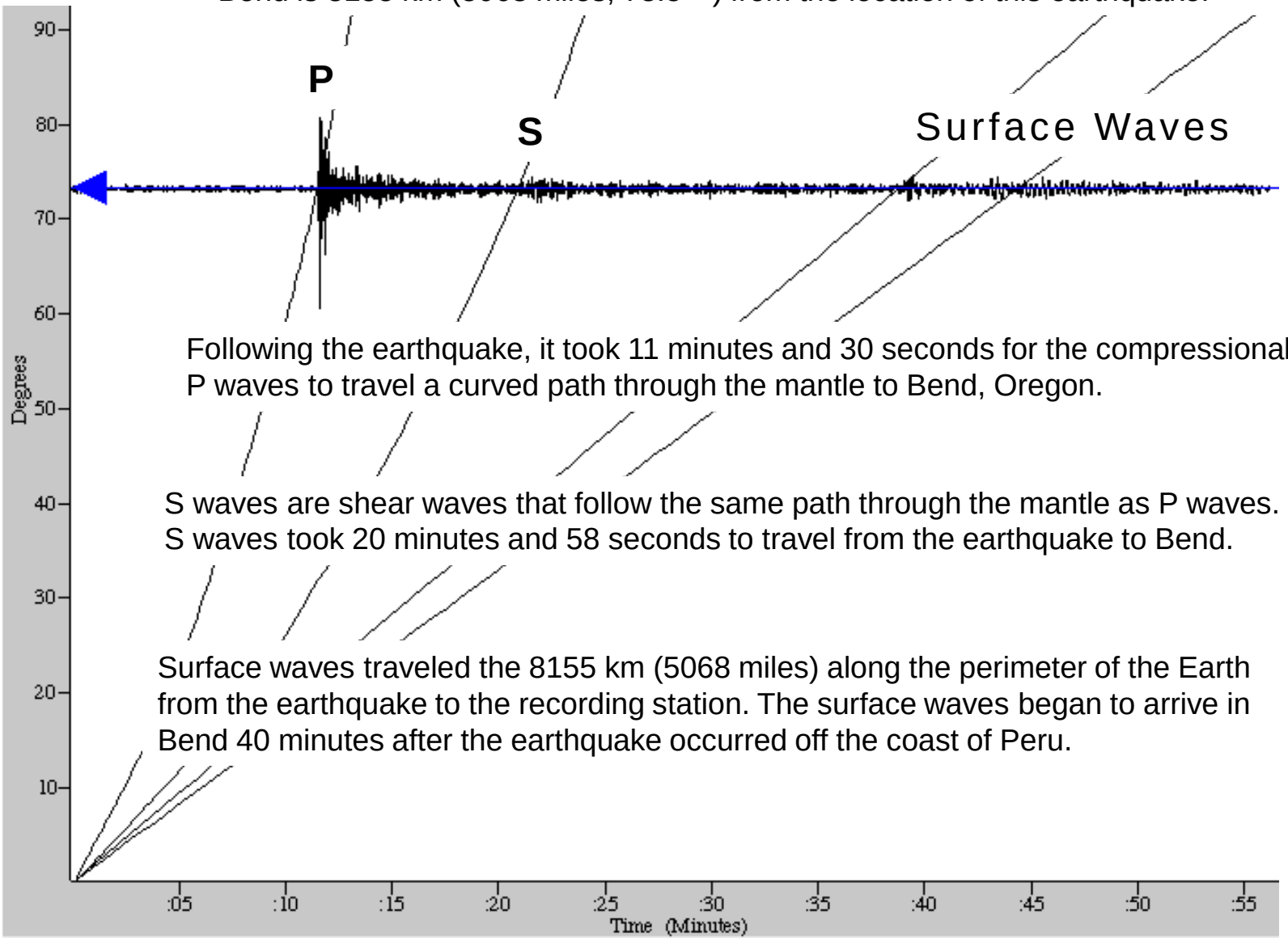
The record of the earthquake in Bend, Oregon (BNOR) is illustrated below. Bend is 8155 km (5068 miles, 73.5˚) from the location of this earthquake.



Following the earthquake, it took 11 minutes and 30 seconds for the compressional P waves to travel a curved path through the mantle to Bend, Oregon.

S waves are shear waves that follow the same path through the mantle as P waves. S waves took 20 minutes and 58 seconds to travel from the earthquake to Bend.

Surface waves traveled the 8155 km (5068 miles) along the perimeter of the Earth from the earthquake to the recording station. The surface waves began to arrive in Bend 40 minutes after the earthquake occurred off the coast of Peru.

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